2014-09-29 day 24

2.6 and 3.1 introduction to the derivative

#11) $\lim_{x \to -2} \frac{2-|x|}{x+2}$ (numerator → 0, denominator → 0) indeterminate

I know $|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$

and I know that as $x \to -2$, I only need to care about neg #s, so

$$\lim_{x \to -2} \frac{2-|x|}{x+2} = \lim_{x \to -2} \frac{2-(-x)}{x+2} = \lim_{x \to -2} \frac{2+x}{x+2} = 1$$

$$\frac{2+x}{x+2} = \frac{x+2}{x+2} = 1$$

$(x \neq -2)$

$$\lim_{x \to -2} 1$$

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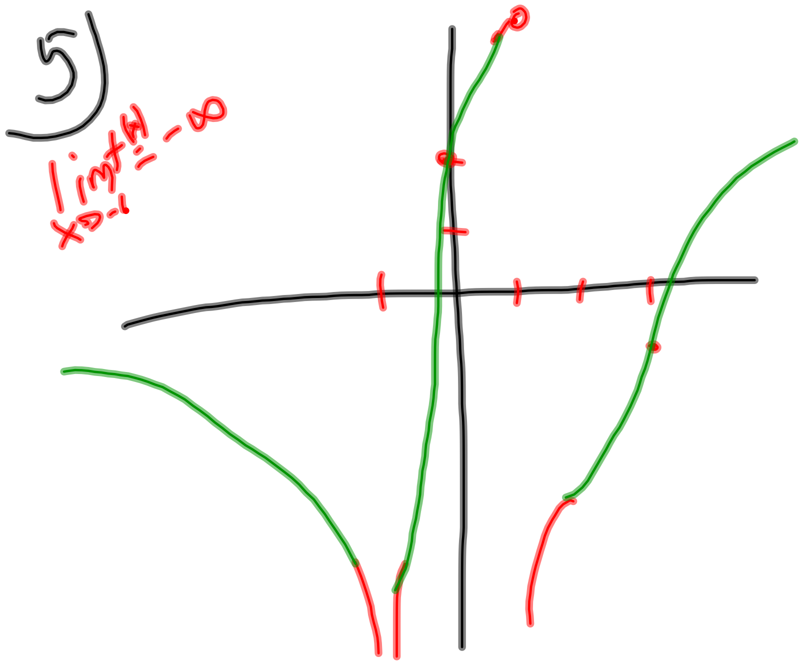

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2.6 and 3.1 introduction to the derivative

9) $f(x) = \begin{cases} x^2 - 3x + 6, & x < 2 \\ -x^2 + 3x + 1, & x \geq 2 \end{cases}$

$\lim_{x \to 2^-} f(x) = \lim_{x \to 2^-} x^2 - 3x + 6 = (2)^2 - 3(2) + 6$

$= 4 - 6 + 6 = 4$

$\lim_{x \to 2^+} -x^2 + 3x + 1 = -(2)^2 + 3(2) + 1$

$= -4 + 6 + 1 = 3$

$\lim_{x \to 2} f(x) = \text{dne}$

$-x^2$ IS NOT $(-x)^2$

ORDER OF OPERATIONS YADA YADA YADA

think: x^2 means $x \cdot x$, so I have to resolve exponents before multiply

the exponent applies to whatever is immediately in front.

$-(2)^2 \quad -(-2)^2$

$-(?)^2$

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2.6 and 3.1 introduction to the derivative

8) $\lim_{x \to 3} \frac{\sqrt{5x+10}}{x-3}$ (numerator → 5, denominator → 0)

this is NOT indeterminate

in fact, I have narrowed the answer down to $+\infty$, $-\infty$, or DNE

$\lim_{x \to 3^-} \frac{\text{sign}(\sqrt{5x+10})}{\text{sign}(x-3)}$ positive / negative $= -\infty$

$\lim_{x \to 3^+} \frac{\text{sign}(\sqrt{5x+10})}{\text{sign}(x-3)}$ positive / positive $= +\infty$

don't agree.

so $\lim_{x \to 3} \frac{\sqrt{5x+10}}{x-3}$ DNE

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2.6 and 3.1 introduction to the derivative

~~$(11)^2 = 11$~~

$$\left(\sqrt{x^2+4}\right)^2 = (x+2)^2 = (x+2)(x+2)$$

$$x^2+4 = x^2+4x+4$$

$$-x^2 \qquad -x^2$$

$$4 = 4x+4$$

$$-4 \qquad -4$$

$$\frac{0}{4} = \frac{4x}{4}$$

$$\boxed{0 = x}$$

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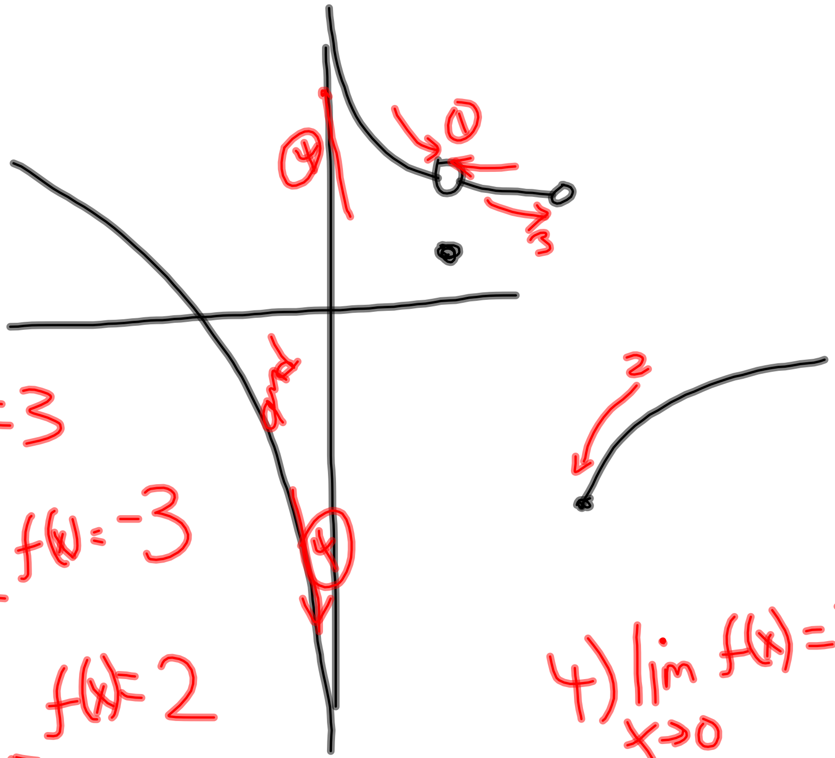
2.6 and 3.1 introduction to the derivative

4)



1) $\lim_{x\to 2} f(x) = 3$

2) $\lim_{x\to 4^+} f(x) = -3$

3) $\lim_{x\to 4^-} f(x) = 2$

4) $\lim_{x\to 0} f(x) = DNE$

↑ 2 sided limit

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2.6 and 3.1 introduction to the derivative

2.6) $\lim_{x\to 0} \frac{2x+\sin x}{x} = \lim_{x\to 0}\left(\frac{2x}{x}+\frac{\sin x}{x}\right)$

$= \lim_{x\to 0} \frac{2x}{x} + \lim_{x\to 0} \frac{\sin x}{x}$

$= \lim_{x\to 0} 2 + \lim_{x\to 0} \frac{\sin x}{x} = 2+1 = 3$